

## Water-Resources Activities of the U.S. Geological Survey in Ohio, 2004

### A century of water science

In November 1898, the U.S. Geological Survey (USGS) established five streamflow-gaging stations in Ohio, thus marking the first USGS involvement in water-resources investigations in the State. These stations were established in cooperation with the Ohio Board of Health to provide data needed to safeguard some of the State's first modern drinking-water supplies. More than 100 years later, the USGS is still cooperating with agencies in Ohio to provide water data needed for hazard protection and wise, safe use of the State's water resources. Certain tax-supported agencies—including the U.S. Army Corps of Engineers, the Ohio Department of Natural Resources, the Miami Conservancy District, and the City of Columbus, Division of Water—have been partners with the USGS for over 20 years.

From the small beginning of five stations, the hydrologic surveillance network operated by the USGS and cooper-

ating agencies has grown to about 120 streamflow-gaging stations and more than 100 ground-water observation wells. Added to this network are hundreds of miscellaneous surface- and ground-water sites where short-term data have been collected for special purposes over the years.

### A mission-driven program

The work of the USGS in Ohio is driven by the overall mission of the USGS. The USGS serves the Nation by providing reliable scientific information to

- describe and understand the Earth,
- minimize loss of life and property from natural disasters,
- manage water, biological, energy, and mineral resources, and
- enhance and protect our quality of life.

Throughout the Nation, the USGS works to constantly improve the base of knowledge on resource availability and potential natural hazards. The active involvement of the USGS in Ohio reflects the State's importance in the national water picture, as well as the willingness of State and local agencies to conduct cooperative water-resource investigations.

Of the many natural resources available, water has been the most crucial to Ohio's growth and economic status. Wise use of Ohio water resources for transportation, water supply, and recreation requires the kinds of data that the USGS and its partner agencies provide.

Water is also Ohio's greatest natural hazard. Nearly every year, floods cost the State thousands or even millions of dollars in damages. Data collected by the USGS have helped reduce flood-related death and damage over the years. Automated streamflow-gaging stations provide early warning of rapid floodwater rises on major streams, whereas long-term data collection and post-flood investigations at hard-hit sites provide statistical information needed to determine flood probabilities and help other agencies delineate flood-prone areas.

### Program highlights

The short discussions on the inside pages highlight some of the most popular and important aspects of USGS water-resources activities in Ohio. Details on the rest of our program can be obtained from the selected contacts listed on the back page.





## Internet-accessible stream data

During the past few years, a major thrust in upgrading the Ohio stream-gaging network has been the linking of stream-stage sensing devices to satellite transmitters, which ultimately feed data to a USGS World Wide Web site. This enables those with Internet access to view recent stage or streamflow data—normally, within 4 hours of data collection—for more than 100 stream stations in Ohio. Round-the-clock availability of this “real-time” data has been a great benefit for water managers—particularly during floods—but it has also been of benefit for

recreationalists who enjoy canoeing, kayaking, and fishing on Ohio’s streams.

Historical data are also available by way of the World Wide Web in viewable and downloadable formats.

## Flood and drought studies

Although floods and droughts cannot be prevented, USGS scientists provide essential information so that water planners and managers can mitigate or prevent some of the damage caused by these hydrologic hazards.

By analyzing long-term streamflow records, USGS scientists have developed statistical techniques for estimating the magnitude and frequency of flooding on streams in urban and rural areas. During floods, USGS field personnel attempt to make streamflow measurements so that extreme streamflows are adequately accounted for in the record. In situations where flooding was too sudden or too severe for measurements to be made, USGS scientists occasionally examine the flooded areas after the fact to estimate peak streamflows.

Several flood-related studies are in progress in Ohio, including a study to model stormwater runoff in Summit County and studies to predict flood profiles and flood-inundation areas on selected streams in Summit, Stark, Lucas, and Fairfield Counties. The USGS recently completed a study in which revised flood-frequency data were presented for streams throughout Ohio. As part of that study, new methods were developed for estimating flood-peak magnitudes that take advantage of digital spatial data and powerful geographic information systems. In a separate study, peak-streamflow data are being collected at selected sites around Ohio that are not part of the standard streamflow-gaging network to augment the existing peak-flow database.

Droughts, although not as sudden as floods, can also be catastrophic to





provide opportunities for developing and testing new technical and analytical methods for subsurface investigations.

Also part of the USGS ground-water history in Ohio has been a technical and advisory role for the Department of Defense, which continues to seek information on the hydrogeology of military installations and technical solutions for ground-water conservation issues. Currently, ground-water personnel housed in the Columbus office provide technical and programmatic assistance for Armed Forces bases nationwide.

Recent ground-water studies in Ohio include (1) investigation of complex ground-water/surface-water interactions along the Great Miami River in Cincinnati and Hamilton, (2) analysis of ground-water quality and geochemistry in Geauga County, Trenton, and the Berlin Lake area, (3) creation of a database containing metadata for ground-water information available for Ohio, (4) tracking of shallow bacterial transport from septic systems, and (5) scenario modeling of ground-water flow in the Great Lakes Basin.

### National Water-Quality Assessment (NAWQA)

The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources. The building blocks of NAWQA are studies of hydrologic systems, called study units, which include parts of major river basins, aquifer systems, and coastal drainages. Study units are sampled on a 10-year cycle of study in order to track water-quality trends. The first cycle of intensive sampling began in 1991.

With cycle II of NAWQA, in 2001, the program focus shifted from status and trends to trends and National priority water-quality issues called topical studies. These topical studies were designed to evaluate (1) the effects of nutrient enrichment on streams, (2) the sources, transport and fate of agricultural chemicals, (3) the transport of contaminants to water-

regional economies when prolonged and severe. The USGS has an ongoing project to measure low flows of selected streams in Ohio that are not part of the standard streamflow-gaging network. Data collected on these streams someday will be used to improve our ability to estimate low-flow characteristics at sites where little or no streamflow data have been collected.

### Microbiological water-quality research

The sanitary quality of water for drinking and recreation is crucial to Ohio and the rest of the Nation. The USGS Ohio District Microbiology Laboratory (ODML) addresses water-related public-health concerns and is housed in the USGS Columbus, Ohio, office. The ODML works with the U.S. Environmental Protection Agency and other cooperators to study the quality of national, state, and local water resources and to test new methods for detection of harmful microbes in water.

Surface water, ground water, and sediments are analyzed for microorganisms of public health significance. These include "indicator bacteria," such as *Clostridium perfringens*, enterococci, and *Escherichia coli* (*E. coli*), which have been associated with pathogenic (disease-causing) organisms responsible for disease outbreaks from fecal contamination. In addition to bacteria, the laboratory also tests for coliphage—a virus that infects *E.*

*coli* and whose presence is an indicator of transport and survival of human pathogenic viruses. In an analytical procedure to detect human pathogenic viruses, the viruses are filtered out of a water sample, concentrated, ultracentrifuged, and then analyzed using a DNA-based procedure.

The ODML is also involved in testing new research methods. An approach to rapidly estimate *E. coli* concentrations within 1 hour involves the use of an immunomagnetic separation (IMS)/adenosine triphosphate (ATP) method. Microbiological source tracking (MST) methods are used to distinguish between human and animal waste. MST methods being tested at the ODML include developing a library of molecular signatures for *E. coli*, identifying the type of coliphage in a sample, and defining specific antibiotic resistance patterns of isolated indicator bacteria.

### Ground-water studies

The USGS and its cooperators have operated a long-term observation-well network since 1938 and have supplemented the basic data derived from this network with numerous special studies. The focus of most special studies is description of subregional to regional ground-water characteristics—availability, quality, and flow direction—as background information for water-supply development or ground-water-resource protection. These ground-water studies not only help the USGS fill gaps in the national ground-water picture but also

supply wells, (4) the effects of urbanization on stream ecosystems, and (5) the bioaccumulation of mercury in aquatic organisms.

In the first 10-year cycle, two study-unit investigations were operated from the Columbus office. The Great and Little Miami River Basins (MIAM) study unit, which covers 7,354 square miles, completed sampling in 2003, and is in the process of publishing study reports. For Cycle II, The MIAM study has been combined with the White River Basin (WHIT) NAWQA study unit in Indiana to form the White and Great and Little Miami River Basins (WHMI) study unit. The WHMI study unit began work in late 2001 and continues sampling today for trends and for three topical studies. The USGS in Ohio investigated the transport of contaminants to water-supply wells for WHMI in the Dayton area.

The Lake Erie-Lake St. Clair Drainages (LERI) study unit covers 22,300 square miles across parts of five states. The study unit represents all the streams that flow into the Lake Erie and Lake St. Clair from the United States. Prior to its anticipated Cycle II start-up in late 2004, the LERI study unit has been in a reduced sampling phase. For the past three years, staff from the Columbus office have collected surface-water samples monthly at 5 of the original 10 LERI sites as part of the trends study. Moreover, 10 monitoring wells from the original 128 sampled during 1995–97 were again sampled in 2002.

## Recent publications

The following is a selected list of publications produced by the USGS in Ohio since January 2003. A full “Bibliography of USGS Publications on Geology and Water in Ohio” can be found by way of the Publications link on the Ohio District World Wide Web page listed in the Additional Information section.

Covert, S.A., and Kula, S.P., 2003, Fish distribution and valley segment type data from Ohio Aquatic Gap Analysis Project (GAP): USGS Open-File Report 03-194, CD.

Francy, D.S., Gifford, A.M. and Darner, R.A., 2003, *Escherichia coli* at Ohio bathing beaches—Distribution, sources, wastewater indicators, and predictive modeling: USGS Water-Resources Investigations Report 02-4285, 120 p.

Funk, J.M., Reutter, D.C., and Rowe, G.L., Jr., 2003, Pesticides and pesticide degradates in the East Fork Little Miami River and William H. Harsha Lake, Southwestern Ohio, 1999–2000: USGS Water-Resources Investigations Report 03-4216, 16 p.

Jackson, K.S., Ostheimer, C.J., and Whitehead, M.T., 2004, Hydrologic and hydraulic analyses of selected streams in Lorain County, Ohio, 2003: USGS Water-Resources Investigations Report 03-4215, 54 p., CD.

Janosy, S.D., 2003, Trace elements and synthetic organic compounds in streambed sediment and fish tissue in the Great and Little Miami River Basins, Ohio and Indiana, 1990–98:

USGS Water-Resources Investigations Report 02-4305, 29 p.

Koltun G.F., 2003, Techniques for estimating flood-peak discharges of rural, unregulated streams in Ohio: USGS Water-Resources Investigations Report 03-4164, 75 p.

Reutter, D.C., 2003, Nitrogen and phosphorus in streams of the Great Miami River Basin, Ohio, 1998–2000: USGS Water-Resources Investigations Report 02-4297, 67 p.

Shaffer, K., 2003, Streamflow and water-quality characteristics of the Ottawa River and selected tributaries in Allen, Hardin, and Putnam Counties, Ohio: USGS Open-File Report 03-215, 43 p.

Sroka, B., 2003, Collecting peak-flow data in Ohio through the use of crest-stage gages: USGS Fact Sheet 059-03, 2 p.

Thomas, Mary Ann, 2003, Arsenic in midwestern glacial deposits—Occurrence and relation to selected hydrogeologic and geochemical factors: USGS Water-Resources Investigations Report 03-4228, 36 p.

## Additional information

For additional information about the USGS and its programs, contact

District Chief  
U.S. Geological Survey, WRD  
6480 Doubletree Avenue  
Columbus, OH 43229-1111  
Email: [dc\\_oh@usgs.gov](mailto:dc_oh@usgs.gov)  
Phone: (614) 430-7700  
Fax: (614) 430-7777

Donna Francy, Water-Quality Specialist  
(614) 430-7769 [dsfrancy@usgs.gov](mailto:dsfrancy@usgs.gov)

Greg Koltun, Surface-Water and Sediment Specialist  
(614) 430-7708 [gfkoltun@usgs.gov](mailto:gfkoltun@usgs.gov)

Rod Sheets, Ground-Water Specialist  
(614) 430-7710 [rasheets@usgs.gov](mailto:rasheets@usgs.gov)

On the World Wide Web:  
<http://oh.water.usgs.gov>

